INEEL/EXT-02-00528
Revision 1

Project No. 23364

Health and Safety Plan for the Central Facilities Area-04 Mercury Pond Sampling and Remedial Action

Jonathan D. Roberts

April 2003

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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ABSTRACT

This health and safety plan establishes the procedures and requirements that will be used to eliminate or minimize health and safety risks to personnel working at the Central Facilities Area (CFA) -04 mercury pond sampling and remedial action site, as required by the Occupational Safety and Health Administration standard, "Hazardous Waste Operations and Emergency Response" (29 Code of Federal Regulations 1910.120). This health and safety plan contains information about the hazards involved in performing the work as well as the specific actions and equipment that will be used to protect personnel while working at the task site.

This health and safety plan is intended to give safety and health professionals the flexibility to establish and modify site safety and health procedures throughout the entire span of site operations based on the existing and anticipated hazards.

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ACRONYMS

ACGIH	American Conference of Government Industrial Hygienists
ACM	asbestos-containing material
ANSI	American National Standards Institute
ARDC	Administrative Record and Document Control
CEL	Chemical Engineering Laboratory
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CRC	contamination reduction corridor
CRZ	contamination reduction zone
DAR	Document Action Request
dBA	decibel A-weighted
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
ERO	Emergency Response Organization
FTL	field team leader
HASP	health and safety plan
HAZWOPER	hazardous waste operations and emergency response
HEPA	high-efficiency particulate air
HSO	health and safety officer
ICP	Idaho Completion Project
INEEL	Idaho National Engineering and Environmental Laboratory
ISMS	Integrated Safety Management System
JSA	job safety analysis

MCP	management control procedure
NIOSH	National Institute of Occupational Safety and Health
NTP	National Toxicology Program
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration
OU	operable unit
PLN	plan
POD	plan of the day
PPE	personal protective equipment
PRD	program requirements document
RadCon	Radiological Control
RCT	radiological control technician
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
RWP	radiological work permit
SAD	site area director
TLV	threshold-limit value
TPR	technical procedure
TRAIN	Training Records and Information Network
TWA	time-weighted average
UV	ultraviolet light
VPP	Voluntary Protection Program
WAG	waste area group
WCC	Warning Communications Center

Health and Safety Plan for the Central Facilities Area-04 Mercury Pond Sampling and Remedial Action

1. INTRODUCTION

1.1 Purpose

This health and safety plan (HASP) establishes the procedures and requirements that will be used to eliminate or minimize health and safety hazards to personnel working at the Central Facilities Area (CFA) -04 mercury pond sampling and remedial action site at the Idaho National Engineering and Environmental Laboratory (INEEL). Figure 1-1 shows the location of the INEEL and its primary facilities.

1.2 Scope and Objectives

This HASP has been written to meet the requirements of the Occupational Safety and Health Administration (OSHA) standard, "Hazardous Waste Operations and Emergency Response (HAZWOPER)" (29 Code of Federal Regulations [CFR] 1910.120). This HASP governs all work at the CFA-04 mercury pond sampling and remedial action site that is performed by INEEL management and operations contractor personnel, subcontractors, and any other personnel who enter the project area. The project scope covers both pre-remedial sampling and remedial action activities, as discussed in the sections below.

This HASP has been reviewed and revised as deemed appropriate by the health and safety officer (HSO) in conjunction with other project personnel and management to ensure its effectiveness and suitability.

1.3 Idaho National Engineering and Environmental Laboratory Site Description

The INEEL, formerly the National Reactor Testing Station, encompasses 569,135 acres (230,321 hectares) and is located approximately 55 km (34 mi) west of Idaho Falls, Idaho. The Department of Energy Idaho Operations Office (DOE-ID) has responsibility for the INEEL and designates authority to operate the INEEL to government management and operating contractors.

The United States Atomic Energy Commission, now the Department of Energy (DOE), established the National Reactor Testing Station (now the INEEL) in 1949 as a site for building and testing a variety of nuclear facilities. The INEEL has also been the storage facility for transuranic radionuclides and radioactive low-level waste since 1952. At present, the INEEL supports the engineering and operations efforts of DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, energy technology and conservation programs, and DOE long-term stewardship programs.

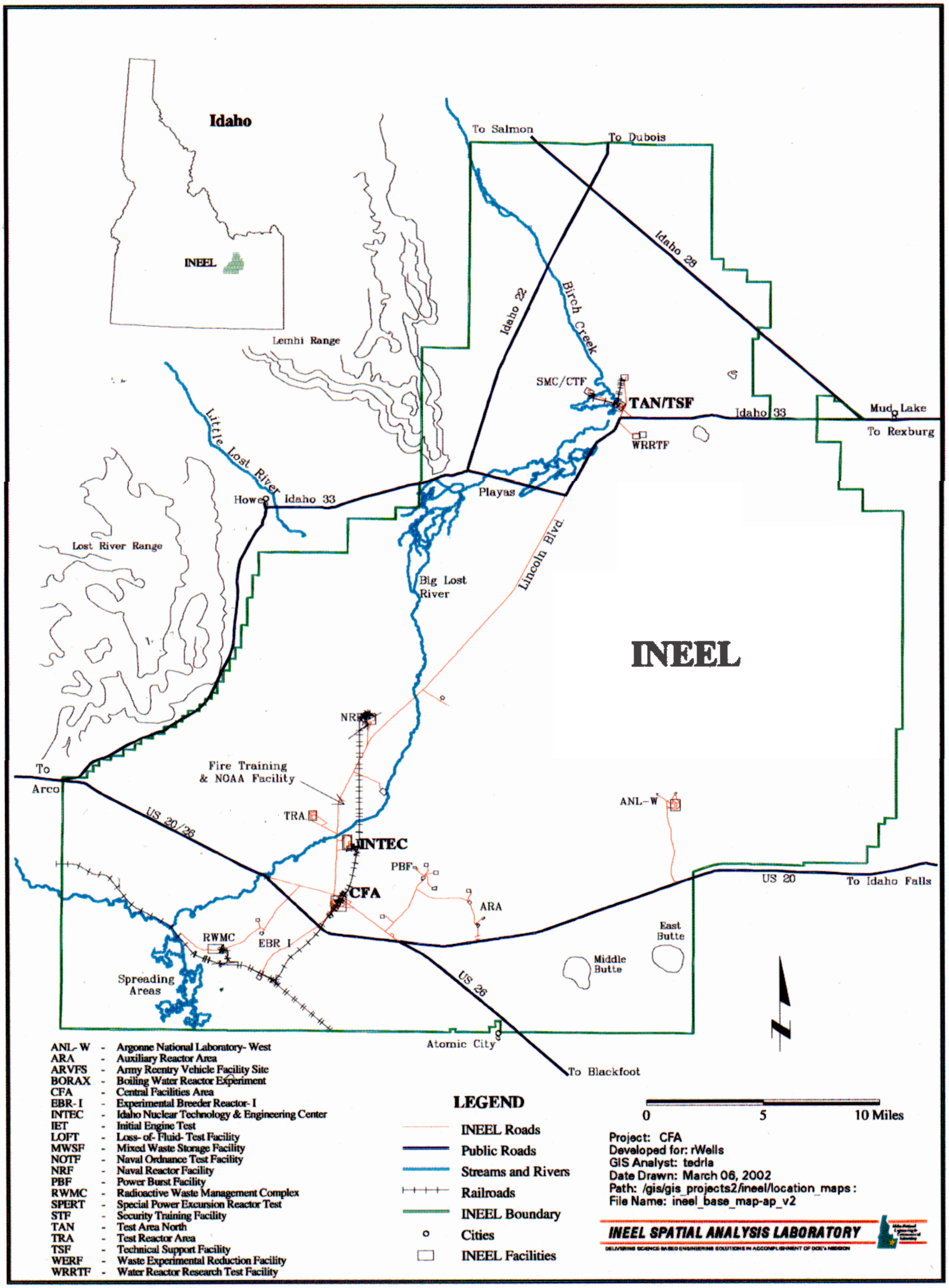

Figure 1-1. Map of the Idaho National Engineering and Environmental Laboratory.

1.4 Background and Project Site Description

The CFA-04 pond is a shallow, unlined surface depression that was originally a borrow pit for construction activities at the CFA (Figure 1-2). It is approximately 46 × 152 m (150 × 500 ft) and roughly 2 to 2.4 m (7 to 8 ft) deep. Basalt outcrops are present within and immediately adjacent to the pond. It received laboratory wastes from the Chemical Engineering Laboratory (CEL) in Building CFA-674 between 1953 and 1969. The CEL was used to conduct calcine experiments on simulated nuclear wastes. The calcining process was later used on actual nuclear waste at the INEEL to change it from a liquid to a solid and to effect an overall volume reduction. The CEL experiments used mercury to dissolve simulated aluminum fuel cladding as well as radioisotope tracers in the calcining process. The primary waste streams discharged to the pond from the CEL included approximately 76.5 m^3 (100 yd^3) of mercury-contaminated calcine that contained low-level radioactive wastes and liquid effluent from the laboratory experiments. In addition, there is approximately 382 m^3 (500 yd^3) of rubble consisting of laboratory bottles, asphalt and asbestos roofing materials, reinforced concrete, and construction and demolition debris. The pond received run-off from the CFA site periodically between 1953 and 1995.

1.4.1 Previous Remediation Efforts and Investigations

The CFA-04 pond was identified as a Track 2 investigation site in the *Federal Facility Agreement and Consent Order* (DOE-ID 1991). Visual inspections in 1994 revealed the presence of calcine on the bermed areas around the periphery of the pond. Following surface and subsurface soil data collection from the calcine and the pond berm in early and mid-1994, a time-critical removal action in September 1994 excavated approximately 218 m^3 (285 yd^3) of calcine and calcine-contaminated soil and a small amount of asbestos from the bermed area. The soil was remediated at a portable retort set up northeast of the pond. Verification soil sampling conducted after the removal action showed that the bermed areas had residual mercury concentrations up to 233 mg/kg.

During the 1995 Track 2 investigation, additional soil samples were collected from the pond inlet area, as well as a deeper area of the pond near the inlet where laboratory effluent may have collected. The results of the 1994 and 1995 soil investigations revealed that concentrations of the following constituents exceeded background concentrations for the INEEL: aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, lead, magnesium, mercury, nickel, Cs-137, Pa-234m, Sr-90, Th-234, U-234, U-235, and U-238. Aroclor-1254 was also detected at low levels. Preliminary risk screening indicated that the following constituents detected at the pond posed potential human health risks: aroclor-1254, arsenic, mercury, Cs-137, U-234, U-235, and U-238. The range of detected concentrations of arsenic was 3.1 to 22.4 mg/kg; mercury, 0.12 to 439 mg/kg; Cs-137, 0.0742 to 2 pCi/g; U-234, 0.651 to 22.6 pCi/g; U-235, 0.0225 to 1.6 pCi/g; and U-238, 0.73 to 35 pCi/g. Based upon these data, the site was recommended for further characterization in the Operable Unit (OU) 4-13 Remedial Investigation/Feasibility Study (RI/FS) (DOE-ID 1996).

Additional soil samples were collected for the OU 4-13 RI/FS during 1997 and 1998 at four areas along the length of the pipe connecting the CEL to the pond, in the area northeast of the pond known as the wind-blown area, and from the pond bottom. Data from these investigations confirmed the presence of mercury in these areas at concentrations up to 439 mg/kg. Four of the 88 samples exceeded the mercury Resource Conservation and Recovery Act (RCRA) characteristic hazardous waste level of 0.2 mg/L. Three of the four samples were in close proximity to one another in the pond, and the fourth was an isolated occurrence in the wind-blown area and was eliminated. A contour line was drawn around the three closely spaced samples and the area was estimated. The depth of the soil in the pond was conservatively estimated to be 2.4 m (8 ft) in the pond bottom and 0.15 m (0.5 ft) in the wind-blown area, indicating that approximately 612 m^3 (800 yd^3) of soil is potentially characteristic waste per RCRA and is subject to land disposal restrictions upon excavation.

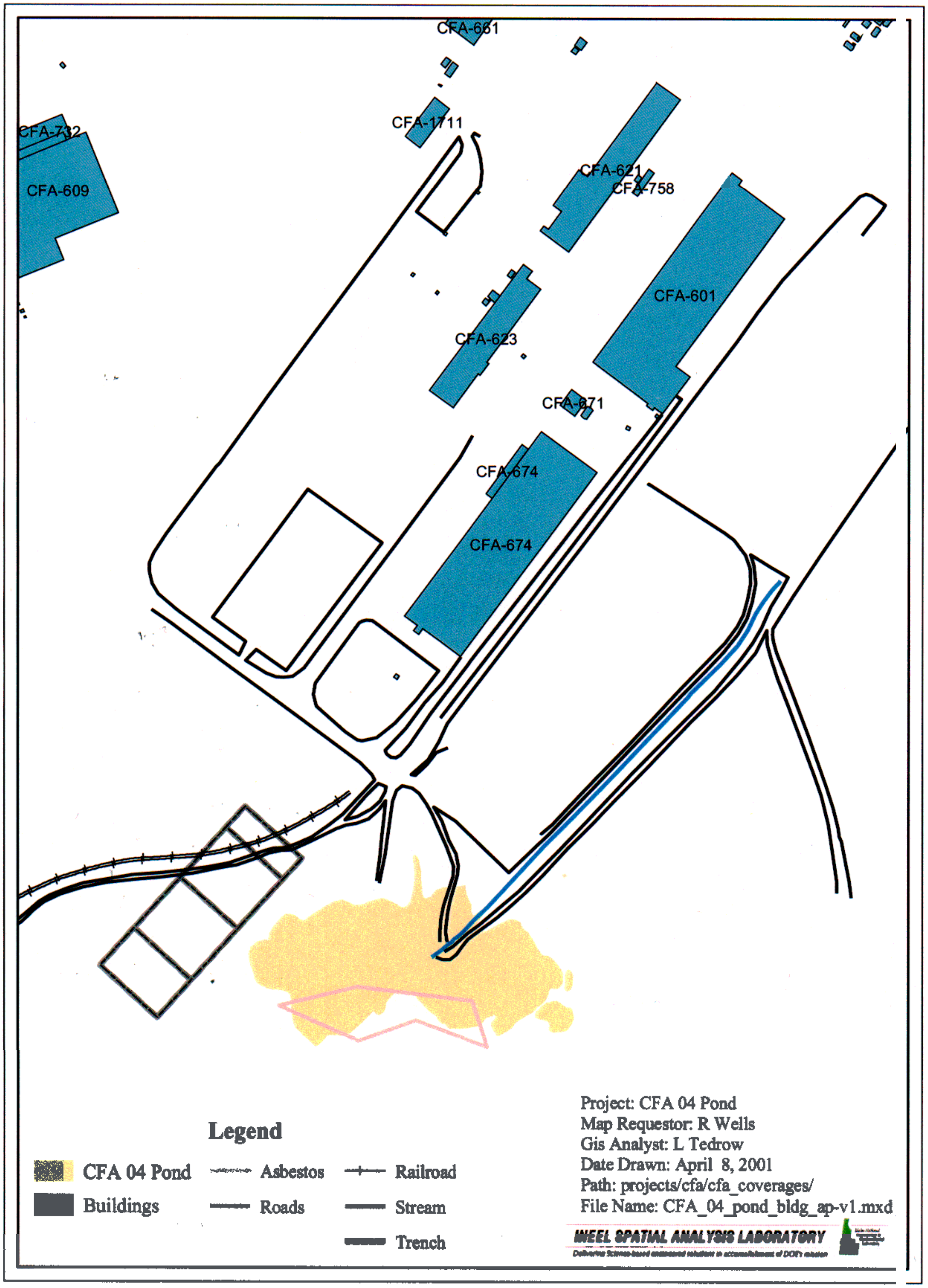

Figure 1-2. Central Facilities Area-04 pond.

The only contaminant that poses an unacceptable risk to human health and the environment is mercury. Mercury-contaminated soil is present in the pond bottom, around the pond periphery in the berms, along the pipe connecting the CEL to the pond, and in the area northeast of the pond as a result of wind-blown contamination. The latter is an area encompassing approximately 91 × 183 m (300 × 600 ft). The OU 4-13 RI/FS conservatively estimated the volume of mercury-contaminated soil to be approximately 6,338 m^3 (8,290 yd^3), based on the dimensions of the pond bottoms, wind-blown area, and pipeline at depths of 2.4 m (8 ft), 0.15 m (0.5 ft), and 1.8 m (6 ft), respectively.

1.4.2 Buried Asbestos

Building CFA-601 was constructed in 1950, and Building CFA-674 was constructed in 1951. Reference construction, remodeling, and repair drawings identify that work was performed on the roofs of these buildings several times during the period from construction until 1982. Other photographs and architectural drawings identify that there were several roofing patch jobs from 1953 to 1967. Building construction drawings show that the built-up roof on each building was about 5 cm (2 in.) thick as designed (4 or 5 ply of roofing felt on 1.5-in. thick insulation). The buildings' proximity to the pond area, and the fact that the buried material appears to match construction document specifications and is definitely roofing material, has led to the supposition that the source of the material is roofing replacements from one or both of these buildings during one or more periods.

If it is postulated that the material from a total re-roofing of each building, and all the identified roofing repairs, was deposited in the CFA-04 pond and then subsequently buried, the amount of asbestos-containing material (ACM) would total approximately 550 m^3 (750 yd^3). The volume of material requiring excavation and repackaging for proper disposal will include roofing material and soils. The volume excavated should not exceed the total buried waste and soil area of 2,600 m^3 (3,400 yd^3).

During the time-critical removal action in 1994, one 4 × 4 × 7-ft wooden waste box containing loose ACM roofing and personal protective equipment (PPE) was removed from the site. Another 57.3 m^3 (75 yd^3) of ACM roofing was unearthed to gain access to calcine waste or to investigate the extent of ACM disposal at the site. This material was subsequently reburied in the southeastern portion of the pond.

Geophysical characterization of the CFA-04 pond was conducted in 1995 and identified the extent of buried ACM roofing in the southern portions of the pond. Several samples collected as part of the RI/FS activities showed little or no mercury contamination in the area where the ACM roofing appears to be buried. Bulk calcine was removed from the site to the extent it was identified. However, granules of loose calcine are contained throughout the site, presumably from wind-blown dispersion. The ACM roofing and commingled soil removed from the site will contain some calcine. However, incidental calcine contamination will not be significant enough to classify the ACM roofing as a hazardous waste. In the unlikely event that bulk calcine is discovered during ACM roofing removal activities, it will need to be separated from the ACM roofing or a separate hazardous waste determination will be required.

1.4.3 Radiological Sampling History

During the comprehensive RI/FS for the CFA OU 4-13, samples of the soils in the pond area were evaluated for radioactivity. The sample analysis revealed above background concentrations of some isotopes in the area of the pond near the inlet of the discharge pipe from CFA-674. In the area of the pond where there appears to be buried material, soil samples were normal background or lower for concentrations of the tracer isotopes. Roofing materials may not have been sampled for radioactivity, but it is not expected that the material from either of the two probable sources would have been radioactively contaminated.

1.5 Scope of Work

The selected remedy for the CFA-04 pond is defined in the *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13* (DOE-ID 2000) as excavation, treatment by stabilization, and on-INEEL disposal for the mercury-contaminated soils. Before excavating the soils, additional samples must be taken to further define the extent of contamination. These data will help determine the specific soil areas to be excavated during the remedial action. The buried asbestos roofing materials will also be excavated and removed from the CFA-04 site. It is anticipated that the excavated soils and asbestos roofing materials will be disposed of at an approved INEEL disposal facility.

1.5.1 Pre-Remedial Sampling

The scope for the pre-remedial sampling is covered in the *Field Sampling Plan for the Pre-Remediation Sampling of the Central Facilities Area-04 Pond* (DOE-ID 2002). Soil samples will be obtained using subcontract personnel operating a drill rig with a hollow-stem auger. Samples will be collected following the procedures delineated in Technical Procedure (TPR) -6559, "Sampling with a Hollow-Stem Auger," as well as the requirements set forth in the subcontractor's scope of work and specifications.

Much of the area to be sampled is covered with a 15- to 30-cm (6- to 12-in.) layer of gravel. Prior to sampling at a given location, the gravel layer will need to be removed by hand digging before using the drill auger. The gravel layer will not require sampling since it was emplaced in 2001 as a fire mitigation method and was not contaminated in the same manner as the pond sediments.

1.5.2 Excavation of Contaminated Soils and Buried Roofing Material

The results from the pre-remediation sampling will help determine the extent of soil excavation required at the CFA-04 site. Detailed information concerning the location and amounts of soils to be excavated will be found in the CFA-04 Remedial Design/Remedial Action Work (RD/RA) Plan. The mercury in the soil is primarily from laboratory calcine waste and wind-blown contamination; the soil is assumed to not contain bulk calcine.

Heavy equipment will be employed in excavating the soils at the CFA-04 site. Some of the soils, depending on pre-remediation sampling results, will be loaded into burrito bags inside roll-off containers or dump trucks. The bags will be sealed and the containers hauled to the INEEL Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF) for storage and/or disposal. Other soil will be loaded into dump trucks and hauled to the CFA landfills for disposal. This includes the asbestos-containing roofing materials that have been determined to be nonfriable (see the CFA-04 RD/RA Work Plan).

1.5.3 Other Activities

Besides excavation and removal of contaminated soils and buried roofing materials, general site cleanup, field and confirmation sampling, and backfill with clean pit run gravel will occur. Miscellaneous construction debris is located throughout the CFA-04 site. This debris will be removed as part of the remediation of the site. Also, soil may be moved around the site to fill in low areas and to generally smooth out the surface of the pond. The outside fence around the pond will be disassembled and removed. Once cleanup activities are complete, the area will then be revegetated with native groundcover to match the site's surroundings.

2. HAZARD IDENTIFICATION AND MITIGATION

The overall objective of this section is to identify existing and anticipated hazards based on the CFA-04 pre-remedial sampling and remedial action scope of work, and to provide controls to eliminate or mitigate these hazards. These include the following:

- Evaluation of each project task to determine the safety hazards and radiological, chemical, and biological exposure potential to project personnel by all routes of entry

- Establishment of the necessary monitoring and sampling required to evaluate exposure and contamination levels, determine action levels to prevent exposures, and provide specific actions to be followed if action levels are reached

- Determination of necessary engineering controls, isolation methods, administrative controls, work practices, and (where these measures will not adequately control hazards) PPE to further protect project personnel from hazards.

The purpose of this hazard identification section is to lead the user to an understanding of the occupational safety and health hazards associated with project tasks. This will enable project management and safety and health professionals to make effective and efficient decisions related to the equipment, processes, procedures, and the allocation of resources to protect the safety and health of project personnel.

The magnitude of danger presented by these hazards to personnel entering work zones is dependent on both the nature of tasks being performed and the proximity of personnel to the hazards. Engineering controls will be implemented (whenever possible) along with administrative controls, work practices, and PPE to further mitigate potential exposures and hazards. This section describes the chemical, radiological, safety, and environmental hazards that personnel may encounter while conducting project tasks. Hazard mitigation provided in this section, in combination with other work controls (e.g., technical procedures, work orders, job safety analyses, and Guide [GDE] –6212, "Hazard Mitigation Guide for Integrated Work Control Process"), will also be used where applicable to eliminate or mitigate project hazards.

2.1 Chemical and Radiological Hazards and Mitigation

Personnel may be exposed to chemical and radiological hazards while working at the CFA-04 remediation site. Preliminary risk screening following the 1994 and 1995 soil investigations indicated that the following constituents detected in the soils at the pond site posed potential health risks: aroclor-1254, arsenic, mercury, Cs-137, U-234, U-235, and U-238. Additional characterization samples were taken during 1997 and 1998. Data from these investigations confirmed the presence of mercury at concentrations up to 439 mg/kg. In accordance with the Record of Decision, the only contaminant that poses an unacceptable risk to human health and the environment is mercury. Project personnel may be exposed to airborne concentrations of mercury either by volatilization of the elemental mercury within the soil, or as part of the dust generated from project activities. Exposure to mercury via dust is not considered a significant hazard due to the fact that mercury is present within the soil in such a low concentration that an extremely high dust level (> 10 mg/m^3) would have to be generated to cause an airborne mercury dust concentration in excess of any exposure limit. Dust on the project will be mitigated via wetting practices to below 10 mg/m^3. In addition, personnel may be exposed to airborne asbestos fibers during the excavation of buried roofing materials. Table 2-1 shows the range of concentrations detected for the contaminants of concern. Table 2-2 lists health-based evaluation information for each contaminant of concern.

Table 2-1. Worker health-based chemical and radiological contaminants of concern.

Chemical or Compound	Range of Detection Low	Range of Detection High	Matrix or Source
Arsenic	3.1 mg/kg	22.4 mg/kg	Soil
Mercury	0.12 mg/kg	439 mg/kg	Soil
Cs-137	0.0742 pCi/g	2 pCi/g	Soil
U-234	0.651 pCi/g	22.6 pCi/g	Soil
U-235	0.0225 pCi/g	1.6 pCi/g	Soil
U-238	0.73 pCi/g	35 pCi/g	Soil

Although naturally occurring and man-made radionuclides have been detected above INEEL background values, the CFA-04 site is not a radiological controlled area; it is neither a radiological material area, nor a soil contamination area. Radiological exposures to site personnel are not expected. However, Radiological Control (RadCon) personnel will review all planned work activities, and any necessary radiological safeguards and controls (i.e., exit surveys, air monitoring, personnel dosimetry) will be implemented.

2.1.1 Routes of Exposure

Exposure pathways exist via inhalation, ingestion, and skin for the contaminants of concern at the project site. Engineering controls, monitoring, training, and work controls will mitigate potential contact and uptake of these hazards; however, the potential for exposure to contaminants still exists.

Chemical and radiological hazards will be eliminated, isolated, or mitigated to the extent possible during all project tasks. Where they cannot be eliminated or isolated, monitoring for chemical and radiological hazards will be conducted (as described in Section 3) to detect and quantify exposures. In addition, administrative controls, training, work procedures, and protective equipment will be used to further reduce the likelihood of exposure to these hazards.

Job safety analyses (JSAs) and radiological work permits (RWPs) may be used in conjunction with this HASP to address specific hazardous operations (e.g., hot work) and radiological conditions at the project site. If used, these documents will further detail specialized PPE and dosimetry requirements.

2.1.2 Specific Project Controls

The primary control on the site will be wetting and misting methods to keep dust and contaminants from becoming airborne. It is anticipated that additional surface spraying will be required during the removal to control any visible dust emissions. Personal protective equipment may also be worn as required by task-specific JSAs and Section 5 of this HASP.

Ingestion of hazardous substances is likely when workers do not take necessary precautions and do not practice good personal hygiene habits. Gloves shall be worn by project personnel whenever they come in contact with potentially contaminated material (e.g., soil, debris, containers, and equipment). Gloves shall be appropriate for the work activity keeping in mind the physical hazards associated with the activity. It is important to wash hands, face, and other exposed skin thoroughly after completion of work and before smoking, eating, drinking, and chewing gum or tobacco.

Table 2-2. Evaluation of health-based contaminants of concern at the Central Facilities Area-04 site.

Material or Chemical (CAS No.) [other information as identified]	Exposure Limit[a] (Permissible Exposure Limit and Threshold Limit Value)	Routes of Exposure	Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)	Matrix or Source at Project Site
Asbestos (1332-21-4; 12001-28-4; 12172-73-5; 77536-66-4; 77536-67-5; 77536-68-6; 132207-32-0)	TLV = 0.1 fiber/cc PEL = 0.1 fiber/cc (29 CFR 1926.1101)	Inhalation, ingestion, and contact hazard	Irritation of eyes and skin, chronic asbestosis, restricted pulmonary function	Eyes and respiratory tract	A1-ACGIH Yes-NTP Yes-IARC Yes-OSHA	Buried ACM roofing material located at southern perimeter of pond. Some roofing materials located on pond surface. Moderate to high exposure potential
Mercury compounds (7439-97-6) [Vapor Pressure: 0.0012 mm Hg]	TLV-TWA = 0.025 mg/m^3 (as inorganic Hg); 0.01 mg/m^3 (as alkyl compound)	Inhalation ingestion, skin absorption, and contact hazard	Inhalation of vapors may cause pneumonitis. Extremely destructive to mucus membrane, upper respiratory tract, eyes, and skin. Burning sensation, coughing, wheezing, laryngitis, short breath, headache, nausea, vomiting, tremors, insomnia.	Central nervous system, vision, kidney, skin, respiratory system	No	Mercury-containing calcine in the soil Low exposure potential

Table 2-2. (continued).

Material or Chemical (CAS No.) [other information as identified]	Exposure Limit[a] (Permissible Exposure Limit and Threshold Limit Value)	Routes of Exposure	Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)	Matrix or Source at Project Site
Radionuclides						
Radionuclides (whole-body exposure)	As per *INEEL Radiation Control Manual*	Whole body	Acute – gastrointestinal disorders, bacterial infections, hemorrhaging, anemia, loss of body fluids, cataracts, temporary sterility Chronic cancer, pre-cancerous lesions, benign tumors, cataracts, skin changes, congenital defects	Blood-forming cells, gastrointestinal tract, and rapidly dividing cells	Yes	Low levels detected in soil samples Low exposure potential

a. Sources: *Threshold Limit Values Booklet* (ACGIH 2002) and substance-specific standards (29 CFR 1910).

TLV = threshold limit value
PEL = permissible exposure limit
ACGIH = American Conference of Government Industrial Hygienists
NTP – National Toxicology Program
IARC = International Agency for Research on Cancer
TWA = time-weighted average
RWP = radiological work permit

During sampling activities, no detectable personnel exposures to mercury are expected. To support this assumption, real-time monitoring will be performed per Section 3 of this HASP. However, several samples will be taken by coring down into areas containing roofing materials. Surface misting of the cuttings being pulled up by the auger will serve as the primary control. Personal protective equipment will also be worn as required by the task-specific JSA and Section 5 of this HASP.

2.2 Safety and Physical Hazards and Mitigation

Industrial safety and physical hazards will be encountered while performing work at the CFA-04 site. Section 4.2 provides general safe-work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to be followed, as applicable, to eliminate or minimize potential hazards to project personnel.

2.2.1 Material Handling and Back Strain

Material handling and maneuvering of various pieces of equipment may result in employee injury. All lifting and material-handling tasks will be performed in accordance with Management Control Procedure (MCP) -2692, “Preventing Ergonomic and Back Disorders.” Personnel will not physically lift objects weighing more than 22 kg (50 lb) or one-third of their body weight (whichever is less) alone. In addition, back strain and ergonomic considerations must be given to material handling and equipment usage. Mechanical and hydraulic lifting devices should be used to move materials whenever possible. The industrial hygienist will conduct ergonomic evaluations of various project tasks to determine the potential ergonomic hazards and provide recommendations to mitigate these hazards. Applicable requirements from Program Requirements Document (PRD) -2016 or MCP-2739, “Material Handling, Storage, and Disposal,” will also be followed.

2.2.2 Working and Walking Surfaces

Slippery or uneven work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. The CFA-04 pond site presents inherent tripping hazards because of the uneven terrain, presence of rocks and debris, and the equipment used during the sampling and remediation work. During the prejob briefing, all personnel will be made aware of tripping hazards that cannot be eliminated. Tripping and slip hazards will be evaluated during the course of the project in accordance with PRD-2005 or PRD-5103, “Walking and Working Surfaces.”

2.2.3 Elevated Work Areas

Personnel may sometimes be required to work on elevated equipment or at heights above 1.8 m (6 ft). During such work, employees will comply with requirements from PRD-2002 or PRD-5096, “Fall Protection,” and applicable requirements from PRD-2006 or MCP-2709, “Aerial Lifts and Elevating Work Platforms”; PRD-2003, “Ladders”; PRD-2004 or PRD-5098, “Scaffolding”; and PRD-2005 or PRD-5103, “Walking and Working Surfaces.” Where required, a fall protection plan will be written.

2.2.4 Powered Equipment and Tools

Powered equipment and tools present potential physical hazards (e.g., pinch points, electrical hazards, flying debris, struck-by, and caught-between) to personnel operating them. All portable equipment and tools will be properly maintained and used by qualified individuals and in accordance with the manufacturer’s specifications. At no time will safety guards be removed. Requirements from PRD-2015, “Hand and Portable Power Tools,” or PRD-5101, “Portable Equipment and Handheld Power Tools,” will be followed for all work performed with powered equipment including hand tools. All tools will be inspected by the user before use.

2.2.5 Electrical Hazards and Energized Systems

Electrical equipment and tools, as well as overhead and underground lines associated with CFA-04 sampling or remediation activities, may pose shock or electrocution hazards to personnel. Safety-related work practices will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. If work on energized systems is necessary, these practices will conform to the requirements in PRD-2011 or PRD-5099, "Electrical Safety"; MCP-3650, "Chapter IX Level I Lockout and Tagouts"; MCP-3651, "Chapter IX Level II Lockouts and Tagouts"; and Parts I through III of the National Fire Protection Association (NFPA) 70E. In addition, all electrical work will be reviewed and completed under the appropriate work controls (e.g., TPRs and work orders). When working around overhead lines, clearances will be maintained at all times. Additionally, all underground utilities and installations will be identified before conducting excavation activities in accordance with PRD-2014, "Excavation and Surface Penetrations."

2.2.6 Fire and Flammable Materials Hazards

Fuel will be required for equipment use during sampling and excavation operations. Flammable hazards are present during refueling activities and with the transfer and storage of flammable or combustible liquids. Portable fire extinguishers with a minimum rating of 10A/60BC will be strategically located at the project site to combat Class ABC fires. They will be located in all active areas, on or near all facility equipment that has exhaust heat sources, and on or near all equipment capable of generating ignition or having the potential to spark. Guidance from MCP-2707, "Compatible Chemical Storage," will be consulted when storing chemicals.

2.2.7 Combustible Materials

Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, or other ignition sources could result in a fire. A fire protection engineer should be contacted if questions arise about potential ignition sources. The accumulation of combustible materials will be strictly controlled. Disposal of combustible materials will be assessed at the end of each shift. Class A combustibles such as trash, cardboard, rags, wood, and plastic will be properly disposed of in appropriate waste containers. The fire protection engineer may also conduct periodic site inspections to ensure that all fire protection requirements are being met.

2.2.8 Flammable and Combustible Liquids

Fuel used at the site for fueling must be safely stored, handled, and used. Only flammable liquid containers approved by the Factory Mutual and Underwriters Laboratories and labeled with the contents will be used to store fuel. All fuel containers will be stored at least 15 m (50 ft) from any facilities and ignition sources, or they will be stored inside an approved flammable storage cabinet. Additional requirements are provided in PRD-2201 or MCP-584, "Flammable and Combustible Liquid Storage and Handling." Portable motorized equipment (e.g., generators and light plants) will be shut off and allowed to cool down in accordance with the manufacturer's operating instructions before being refueled to minimize the potential for a fuel fire.

2.2.9 Welding, Cutting, or Grinding

Personnel conducting welding, cutting, or grinding tasks may be exposed to molten metal, slag, and flying debris. In addition, a fire potential exists if combustible materials are not cleared from the work area. Requirements from PRD-2010 or PRD-5110, "Welding, Cutting, and Other Hot Work," will be followed whenever these types of activities are conducted.

2.2.10 Pressurized Systems

A variety of heavy equipment vehicles will be operated at the project site. The hazards presented to personnel, equipment, facilities, or the environment because of inadequately designed or improperly operated pressure (or vacuum) systems include blast effects, shrapnel, fluid jets, release of toxic or asphyxiant materials, contamination, equipment damage, personnel injury, and death. These systems can include pneumatic, hydraulic, vacuum, or compressed gas systems.

All pressure systems will be operated in the designed operating pressure range, which is typically 10 to 20% less than the maximum allowable working pressure. In addition, all hoses, fittings, lines, gauges, and system components will be rated for the system for at least the maximum allowable working pressure (generally the relief set point). The project safety professional should be consulted about any questions of pressure systems in use at the project site.

2.2.11 Compressed Gases

All cylinders will be used, stored, handled, and labeled in accordance with PRD-2009, "Compressed Gases." The safety professional should be consulted about any compressed gas cylinder storage, transport, and usage issues.

2.2.12 Heavy Equipment and Moving Machinery

Hazards associated with the operation of heavy equipment include injury to personnel (e.g., struck-by and caught-between hazards) and equipment and property damage. All heavy equipment will be operated in the manner in which it was intended and in accordance with manufacturer's instructions. Only authorized qualified personnel will be allowed to operate equipment; personnel near operating heavy equipment must maintain visual communication with the operator. Personnel will comply with PRD-2020 or MCP-2745, "Heavy Industrial Vehicles," and PRD-2019 or PRD-5123, "Motor Vehicle Safety."

Personnel working around or near cranes or boom trucks will also comply with PRD-160, "Hoisting and Rigging," as applicable and appropriate.

Additional safe practices will include the following:

- All heavy equipment will have backup alarms.
- Walking directly behind or to the side of heavy equipment without the operator's knowledge is prohibited. All precautions will be taken before moving heavy equipment.
- While operating heavy equipment in the work area, the equipment operator will maintain communication with a designated person who will be responsible for providing direct voice contact or approved standard hand signals. In addition, all facility personnel in the immediate work area will be made aware of the equipment operations.
- All equipment will be kept out of traffic lanes and access ways; it will be stored to prevent endangerment to personnel at any time.
- All unattended equipment will have appropriate reflectors or be barricaded if left on roadways.

- All parked equipment will have the parking brake set and chocks will be used when equipment is parked on inclines.

- The swing radius of heavy equipment will be adequately barricaded or marked to prevent personnel from entering into the swing radius.

2.2.13 Excavation, Surface Penetrations, and Outages

Excavation activities will be conducted in conjunction with CFA-04 remediation activities. All surface penetrations and related outages will be coordinated through the field team leader or subcontract technical representative and will require submittal of an outage request (i.e., Form 433.01, "Outage Request") for outages (e.g., road, electrical, and water). The submission of an outage request will not be considered an approval to start the work. Other specific outage requirements are addressed in the special conditions section of the management and operating contract. No surface penetrations will be allowed or conducted until the area has been evaluated and an approved subsurface evaluation documented.

All excavation activities will be conducted and monitored in accordance with PRD-2014 or PRD-22, "Excavation and Surface Penetrations," and 29 CFR 1926, Subpart P, "Excavations." The following are some key elements from these requirements:

- The location of utility installations (e.g., sewer, telephone, fuel, electric, water lines, or any other underground installations) that may reasonably be expected to be encountered during excavation work will be determined before opening an excavation.

- Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design and will be constructed in accordance with the design. Structural ramps will be inspected in accordance with Form 432.57, "Excavation Checklist."

- Employees exposed to public vehicular traffic will be provided with, and will wear, warning vests or other suitable garments marked with or made of reflective or high-visibility material.

- Daily inspections of excavations, areas adjacent to the excavations, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be conducted by the competent person before the start of work and as needed throughout the shift. Inspections will also be made after every rainstorm or other hazard-increasing occurrence.

- Sloping or benching will be constructed and maintained in accordance with the requirements set forth in PRD-2014 or PRD-22, "Excavation and Surface Penetrations," for the soil type as classified by the competent person. This classification of the soil deposits will be made based on the results of at least one visual inspection and at least one manual analysis.

2.2.14 Hoisting and Rigging of Equipment

As applicable for project operations, all hoisting and rigging will be performed in accordance with PRD-2007 or PRD-160, "Hoisting and Rigging," and DOE Standard (STD) -1090-01, "Hoisting and Rigging." Hoisting and rigging equipment will show evidence of a current inspection (e.g., tag) and be inspected before use by qualified personnel. The operator or designated person for mobile cranes or boom trucks will also perform a visual inspection each day or before use (if the crane has not been in regular service) of items such as, but not limited to, the following:

- All control mechanisms for maladjustment that would interfere with proper operation
- Crane hooks and latches for deformation, cracks, and wear
- Hydraulic systems for proper oil level
- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage
- Hoist ropes for kinking, crushing, birdcaging, and corrosion
- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

NOTE: *The operator or other designated person will examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they will be reported to the safety professional.*

2.2.15 Drilling Hazards

A wireline core rig with a rotating auger will be used at the project site to draw core samples from the designated sample locations. Some anticipated hazards include hoisting material with catlines, slippery or cluttered work surfaces, and working around a rotating auger.

Catlines are used on drilling rigs to hoist material. Accidents that occur during catline operations may injure the worker doing the rigging as well as the operator. Minimal control over hoisting materials can cause sudden and erratic load movements that may result in hand and foot injuries.

Working surfaces around drill rigs can often become cluttered with tools, equipment, and cuttings. Such work surfaces can increase the likelihood of slips, trips, and falls. Good housekeeping and a general awareness of work surroundings will help minimize these risks.

The sampling rig operates with a rotating auger. The nature of the work requires workers to be near the auger while it is rotating. Serious injury could occur if equipment or a worker’s clothing is caught in the rotating auger. Workers must take special care and remain alert while working near the auger.

2.2.16 Material Handling

The most common type of accident that occurs during material handling is when a load is being handled and a finger or toe is caught between two objects. Rolling stock can shift or fall from a pipe rack or truck bed. Fingers and hands can be caught between sampling barrels, breakout vices, and tools.

2.2.17 Personal Protective Equipment

Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. In addition, PPE can increase the risk of heat stress. Work activities at the task site will be modified as necessary to ensure that personnel are able to work safely in the required PPE. Work-site personnel will comply with PRD-2001 or PRD-5121, “Personal Protective Equipment,” and MCP-432, “Radiological Personal Protective Equipment.” All personnel who wear PPE will be trained in its use and limitations in accordance with PRD-2001 or PRD-5121.

2.2.18 Decontamination

Decontamination procedures for personnel and equipment are detailed in Section 11. Potential hazards to personnel conducting decontamination tasks include back strain; slip, trip, and fall hazards; and cross-contamination from contaminated surfaces. In addition, electrical hazards may be present if powered equipment (e.g., a powered pressure washer) is used. Mitigation of these walking surface hazards and electrical hazards is addressed in prior subsections. If a power washer or heated power washer is used, units will be operated in accordance with the manufacturer's operating instructions; personnel will wear appropriate PPE to prevent high-pressure spray injuries; personnel will use ground-fault circuit protection; and these tasks will only be conducted in approved areas. Personnel will wear required PPE at all times during decontamination tasks, as listed in Section 5.

2.3 Environmental Hazards and Mitigation

Potential environmental hazards could endanger personnel during project tasks. These hazards will be identified and mitigated to the extent possible. The following subsections describe these environmental hazards and state the procedures and work practices that will be followed to mitigate them.

2.3.1 Noise

Personnel involved in project activities may be exposed to noise levels that exceed 85 decibel A-weighted (dBA) for an 8-hour time-weighted average (TWA) or 83 dBA for a 10-hour TWA. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear and pain and temporary or permanent hearing loss
- Interference with communication that would warn of danger.

Where noise levels are suspected of exceeding 80 dBA, noise measurements will be performed in accordance with PRD-2108, "Hearing Conservation," or MCP-2719, "Controlling and Monitoring Exposures to Noise," to determine if personnel are routinely exposed to noise levels in excess of the applicable TWA (85 dBA for 8 hours of exposure or 83 dBA for 10-hour exposures).

Personnel whose noise exposure routinely meets or exceeds the allowable TWA will be enrolled in the INEEL Occupational Medical Program (OMP) (or subcontractor hearing conservation program, as applicable). Personnel working on jobs that have noise exposures greater than 85 dBA (83 dBA for a 10-hour TWA) will be required to wear hearing protection until noise levels have been evaluated, and they will continue to wear the hearing protection specified by the industrial hygienist until directed otherwise. Hearing protection devices will be selected and worn in accordance with PRD-2108 or MCP-2719.

2.3.2 Temperature and Ultraviolet Light Hazards

Project tasks will be conducted during times when there is a potential for heat stress that could present a hazard to personnel. The industrial hygienist and HSO will be responsible for obtaining meteorological information to determine if additional heat stress administrative controls are required. All project personnel must understand the hazards associated with heat stress and take preventive measures to minimize the effects. "Heat and Cold Stress" (PRD-2107 or MCP-2704) guidelines will be followed when determining work-rest schedules or when halting work activities because of temperature extremes.

2.3.2.1 Heat Stress. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort, unconsciousness, to death. In addition, tasks requiring the use of protective equipment or respiratory protection prevent the body from cooling. Personnel must inform the field team leader (FTL) or HSO when experiencing any signs or symptoms of heat stress or when observing a fellow employee (i.e., buddy) experiencing them. Heat stress stay times will be documented on the appropriate work control document(s), (i.e., a JSA, Prejob Briefing Form, or other) by the HSO in conjunction with the industrial hygienist (as required) when personnel wear PPE that may increase heat body burden. These stay times will take into account the amount of time spent on a task, the nature of the work (i.e., light, moderate, or heavy), type of PPE worn, and ambient work temperatures. Table 2-3 lists heat stress signs and symptoms of exposure.

Table 2-3. Heat stress signs and symptoms of exposure.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating.	Keep the skin clean, change all clothing daily, and cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps and exhaustion, sometimes with dizziness or periods of faintness.	Move the patient to a nearby cool place. Give the patient half-strength electrolytic fluids. If cramps persist, or if signs that are more serious develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; **cold, clammy skin; heavy perspiration;** total body weakness; dizziness that sometimes leads to unconsciousness.	Move the patient to a nearby cool place. Keep the patient at rest. Give the patient half-strength electrolytic fluids. Treat for shock, and seek medical attention. DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT.
Heat stroke	Deep, then shallow, breathing; rapid, strong pulse, then rapid, weak pulse; **dry, hot skin**; dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching.	Cool the patient rapidly. Treat for shock. If cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. DO NOT ADMINISTER FLUIDS OF ANY KIND.

NOTE: *Heat exhaustion and heat stroke are extremely serious conditions that can result in death and should be treated as such. The FTL or designee should immediately request an ambulance (777 or 526-1515) be dispatched from the CFA-1612 medical facility, and the individual should be cooled, as described above in Table 2-3, based on the nature of the heat stress illness.*

2.3.2.2 Ultraviolet Light Exposure. Personnel will be exposed to ultraviolet light (UV) (i.e., sunlight) when conducting project tasks. Sunlight is the main source of UV known to damage the skin and to cause skin cancer. The amount of UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. No UV rays or suntans are safe. The following are mitigative actions to take to minimize UV exposure:

- Wear clothing to cover the skin (long pants [no shorts] and long sleeve or short sleeve shirt [no tank tops])
- Use a sunscreen with a sun protection factor of at least 15
- Wear a hat (hard hat, where required)
- Wear UV-absorbing safety glasses
- Limit exposure during peak intensity hours of 10 a.m. to 4 p.m., whenever possible.

2.3.3 Inclement Weather Conditions

When inclement or adverse weather conditions develop that may pose a threat to persons or property at the project site (e.g., sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold), conditions will be evaluated and a decision made by the HSO with input from other personnel to halt work, employ compensatory measures, or proceed. The FTL and HSO will comply with INEEL MCPs and facility work control documents that specify limits for inclement weather.

2.3.4 Subsidence

Personnel may be exposed to subsidence hazards from buried waste pits and trenches or uncompacted, backfilled excavation areas during project activities. This is primarily an equipment hazard when driving or operating equipment in subsidence areas; however, personnel may also be at risk from walking in these areas.

2.3.5 Biological Hazards

The INEEL is located in an area that provides habitat for various rodents, insects, and vectors (i.e., organisms that carry disease-causing microorganisms from one host to another). The potential exists for encountering nesting materials or other biological hazards and vectors. The Hantavirus may be present in the nesting and fecal matter of deer mice. If such materials are disturbed, they can become airborne and create a potential inhalation pathway for the virus. Contact and improper removal of these materials may provide additional inhalation exposure risks.

If suspected rodent nesting or excrement material is encountered, the industrial hygienist will be notified immediately and **no attempt will be made to remove or clean the area**. Following an evaluation of the area, disinfection and removal of such material will be conducted in accordance with MCP-2750, "Preventing Hantavirus Infection."

Snakes, insects, and arachnids (e.g., spiders, ticks, and mosquitoes) may also be encountered. Common areas to avoid include material stacking and staging areas, under existing structures (e.g., trailers and buildings), under boxes, and other areas that provide shelter. Protective clothing will generally prevent insects from direct contact with the skin. If potentially dangerous snakes or spiders are found or are suspected of being present, warn others, keep clear, and contact the industrial hygienist or HSO for additional guidance (as required).

Insect repellant (DEET or equivalent) may be required. Areas where standing water has accumulated (e.g., evaporation ponds) provide breeding grounds for mosquitoes and should be avoided. In cases where a large area of standing water is encountered, it may be necessary to pump the water out of the declivity (areas other than the evaporation ponds).

2.3.6 Confined Spaces

There are no identified confined spaces at the project site. Contact the industrial hygienist if there is any question as to whether a space may meet the definition of a confined space. If entry into a confined space is required, then all requirements of MCP-2749, "Confined Spaces," will be followed.

2.4 Other Task-Site Hazards

Task-site personnel should continually look for potential hazards and immediately inform the FTL or HSO of the hazards so that action can be taken to correct the condition. All personnel have the authority to initiate STOP WORK actions in accordance with PRD-1004 or MCP-553, "Stop Work Authority," if it is perceived that an imminent safety or health hazard exists or take corrective actions within the scope of the work control authorization documents to correct minor safety or health hazards and then inform the FTL.

Personnel working at the task site must use safe-work practices, report unsafe working conditions or acts, and exercise good housekeeping habits with respect to tools, equipment, and waste throughout the course of the project.

2.5 Site Inspections

Project personnel may participate in site inspections during the work control preparation stage (such as the hazard identification and verification walk-downs) and may conduct self-assessments or other inspections. In addition, periodic safety inspections will be performed by the HSO, project manager, or FTL in accordance with MCP-3449, "Safety and Health Inspections."

Targeted or required self-assessments may be performed during investigation and sampling operations in accordance with MCP-8, "Self-Assessment Process for Continuous Improvement." All inspections and assessments will be documented and available for review by the FTL. These inspections will be noted in the FTL logbook. Health and safety professionals present at the task site may, at any time, recommend changes in work habits to the FTL. However, all changes that may affect the work control documents must have concurrence from the appropriate project technical representatives, and a data analysis report will be prepared (when required).

3. EXPOSURE MONITORING AND SAMPLING

A potential for exposure to radiological, chemical, or physical hazards exists during project tasks. Refinement of work control zones (see Section 7), use of engineering and administrative controls, worker training, and wearing PPE provide the mitigation strategy for these hazards. Monitoring and sampling will be used during project tasks to (1) assess the effectiveness of these controls, (2) determine the type of PPE needed for individual tasks, and (3) determine the need for upgrading and downgrading PPE, as described in Section 5. Monitoring will be conducted in and around the active work location(s) on a periodic basis and as determined based on site-specific conditions.

Table 3-1 lists the hazards to be monitored and the monitoring instruments that may be used. Table 3-2 lists the action levels and associated responses for specific hazards.

3.1 Exposure Limits

Exposure limits identified in Table 3-2 serve as the initial action limits for specific project tasks. Project tasks will be continually assessed in accordance with PRD-25, "Activity Level Hazard Identification, Analysis, and Control," and evaluated by RadCon and Industrial Hygiene personnel to ensure engineering control effectiveness. Action limits should be adjusted, as required, based on changing site conditions, exposure mitigation practices, and PPE levels.

3.2 Environmental and Personnel Monitoring

Industrial Hygiene and RadCon personnel will conduct periodic monitoring with direct-reading instrumentation, collect swipes, and will conduct full- and partial-period air sampling (as deemed appropriate) in accordance with the applicable MCPs, OSHA substance-specific standards, and INEEL manuals. Instrumentation listed on Table 5-1 will be selected based on the site-specific conditions and contaminants associated with project tasks. The radiological control technician (RCT) and industrial hygienist will be responsible for determining the best monitoring technique for radiological and nonradiological contaminants (respectively). Safety hazards and other physical hazards will be monitored and mitigated, as outlined in Section 2.

3.2.1 Industrial Hygiene Area and Personal Monitoring and Instrument Calibration

The project industrial hygienist will conduct full- and partial-period sampling of airborne contaminants and monitoring of physical agents at a frequency deemed appropriate based on direct-reading instrument readings and changing site conditions. When conducted, all air sampling will be conducted using applicable National Institute of Occupational Safety and Health (NIOSH), OSHA, or other validated method. Both personal and area sampling and monitoring may be conducted.

Various direct-reading instruments may be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by changing site conditions, direct-reading instrument results, observation, professional judgment, and in accordance with MCP-153, "Industrial Hygiene Exposure Assessment."

All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, existing Industrial Hygiene protocol, and in conformance with the companywide safety and health manuals, *Manual 14A—Safety and Health—Occupational Safety and Fire Protection* and *Manual 14B—Safety and Health—Occupational Medical and Industrial Hygiene*. Direct-reading instruments will be calibrated, at a minimum, before daily use and more frequently as determined by the project industrial hygienist. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded as stated in Section 12.

Table 3-1. Hazards to be monitored and monitoring instruments.

Hazard to be Monitored	Monitoring Instrument Description[a,b]
Hazardous noise	ANSI Type S2A sound level meter or ANSI S1.25-1991 dosimeter (A-weighted scale for time-weighed average dosimetry, C-weighted for impact dominant sound environments).
Heat stress	Heat stress—wet-bulb globe temperature, body weight, fluid intake.
Mercury	Jerome Mercury Vapor Analyzer (or equivalent) Personal sampling pumps with appropriate media for partial and full period sampling using NIOSH or OSHA-validated methods. Passive Mercury Badges.
Asbestos	Personal sampling pumps with appropriate media for partial and full period sampling using NIOSH or OSHA-validated methods.
Dust	Direct-reading instrument (miniram or DustTrak) Personal sampling pumps with appropriate media for partial and full period sampling using NIOSH or OSHA-validated methods.
Ionizing radiation	(Alpha) Count rate—Bicron/NE Electra (DP-6 or AP-5 probe) or equivalent. Stationary—Eberline RM-25 (HP-380AB or HP-380A probe) or equivalent. (Beta-gamma) Count rate—Bicron NE/Electra (DP-6, BP-17 probes) or equivalent. Stationary—Eberline RM-25 (HP-360AB probe) or equivalent.
Radionuclide contamination	CAM—ALPHA 6-A-1 (in-line and radial sample heads, pump, RS-485) or equivalent (as required). CAM (beta)—AMS-4 (in-line and radial head, pump RS-485) or equivalent (as required). Grab sampler—SAIC H-810 or equivalent.

a. Monitoring and sampling will be conducted as deemed appropriate by project Industrial Hygiene and Radiological Control personnel based on specific tasks and site conditions.
b. Equivalent instrumentation other than those listed may be used.
ANSI = American National Standards Institute
CAM = continuous air monitor

Table 3-2. Action levels and associated responses for identified hazards.

Contaminant/Agent Monitored	Action Level	Response Taken If Action Levels Are Exceeded
Asbestos	0.1 fiber/cc	Stop Work. Reevaluate work process and controls.
Mercury vapor	0.01 mg/m^3 sustained in breathing zone.	Move personnel to upwind position of source. Use wetting or misting methods. <u>IF</u> wetting or misting methods prove ineffective, <u>THEN</u> don respiratory protection[a] and protective clothing (as directed by industrial hygienist).
Dust, nuisance particulates	>10 mg/m^3 (inhalable fraction) >3 mg/m^3 (respirable fraction)	Move personnel to upwind position of source. Close equipment cab windows and doors. Use wetting or misting methods to minimize dust and particulate matter. <u>IF</u> wetting or misting methods prove ineffective, <u>THEN</u> don respiratory protection[a] (as directed by industrial hygienist).
Hazardous noise levels	<85 dBA 8-hour TWA, <83 dBA 10-hour TWA	No action.
	85 to 114 dBA	Hearing protection required to attenuate hazard to below 85 dBA 8-hour TWA or 83 dBA for 10-hour TWA (device NRR).
	(a) >115 dBA	(a) Isolate source. Evaluate NRR for single device. Double protection as needed.
	(b) >140 dBA	(b) Control entry. Isolate source. Only approved double protection worn.
Radiation field	<5 mrem/hour	No action, no posting required.
	5 to 100 mrem/hour at 30 cm (10 CFR 835.603.b)	Post as "Radiation Area"—Required items: Radiological Worker I or II training, RWP, personal dosimetry.
Radionuclide contamination	1 to 100 times Radiological Control Manual[b] Table 2-2 values (10 CFR 835.603.d)	Post as "Contamination Area"—Required items: RW II training, personal dosimetry, RWP, don PPE, bioassay submittal (as required).
Airborne radioactivity	Concentrations (µCi/cc) >30% of and derived air concentration value (10 CFR 835.603.d)	Post as "Airborne Radioactivity Area"—Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).

a. Level C respiratory protection will consist of a full-face respirator equipped with filter cartridge(s), as prescribed by the project Industrial Hygiene and Radiological Control personnel (based on contaminant of concern). See Section 5 for additional Level C requirements.
b. *Manual 15—Radiation Protection—INEEL Radiological Control* (PRD-183).
NRR = noise reduction rating

3.2.2 Area Radiological Monitoring and Instrument Calibration

Area radiological monitoring may be conducted during project tasks to ensure that personnel are given adequate protection from potential radiological exposure. Instruments and sampling methods listed in Table 3-1 may be used by the RCT, as deemed appropriate and as required by project or task-specific RWPs. When conducted, monitoring will be performed in accordance with *Manual 15B—Radiation Protection Procedures* and *Manual 15C—Radiological Control Procedures.* The data obtained from monitoring will be used by RadCon personnel to evaluate the effectiveness of engineering controls, decontamination methods and procedures, and to alert personnel to potential radiation sources.

Radiological Control personnel may use radiation and contamination detectors and counters listed in Table 3-1, or equivalent instruments, to provide radiological information to personnel. Daily operational and source checks will be performed on all portable survey instruments to ensure that they are within the specified baseline calibration limits. Accountable radioactive sources will be maintained in accordance with MCP-137, "Radioactive Source Accountability and Control." All radiological survey and monitoring equipment will be maintained and calibrated in accordance with the manufacturer's recommendations, existing RadCon protocol, and in conformance with MCP-93, "Health Physics Instrumentation."

3.2.3 Personnel Radiological Exposure Monitoring

Personal radiological monitoring will be conducted to quantify radiation exposure and potential for uptakes as stated in the project or task-specific RWP. This may include the use of external dosimetry, surface monitoring, and internal dosimetry methods to ensure that engineering controls, administrative controls, and work practices are effectively mitigating radiological hazards.

3.2.3.1 External Dosimetry. Dosimetry requirements will be based on the radiation exposure potential during project tasks. When dosimetry is required, all personnel who enter the project area will be required to wear personal dosimetry devices, as specified by RadCon personnel and the RWP, and in accordance with *Manual 15A—Radiation Protection INEEL Radiological Control*.

4. ACCIDENT AND EXPOSURE PREVENTION

Project activities will present numerous hazards to project personnel. It is critical that all personnel understand and follow the site-specific requirements of this HASP and other work control documents. Engineering controls, hazard isolation, specialized work practices, and the use of PPE will all be implemented to eliminate or mitigate all potential hazards and exposures (where feasible). However, all personnel are responsible for the identification and control of hazards in their work area in accordance with Integrated Safety Management System (ISMS) principals and practices. **At no time will hazards be left unmitigated without implementing some manner of controls (e.g., engineering controls, administrative controls, or the use of PPE)**. Project personnel should use stop work authority in accordance with PRD-1004 or MCP-553, “Stop Work Authority,” where it is perceived that imminent danger to personnel, equipment, or the environment exists.

This HASP is to be used in conjunction with PRD-25, “Activity Level Hazard Identification, Analysis, and Control,” and work authorization and control documents such as Standard (STD) –101, “Integrated Work Control Process”; work orders; JSAs; MCP-3562, “Hazard Identification, Analysis, and Control of Operational Activities”; and operational technical procedures.

4.1 Voluntary Protection Program and Integrated Safety Management

The INEEL safety processes embrace the Voluntary Protection Program (VPP) and ISMS criteria, principles, and concepts to identify and mitigate hazards, thereby preventing accidents. All management and workers are responsible for implementing safety policies and programs and for maintaining a safe and healthful work environment. Project personnel are expected to take a proactive role in preventing accidents, ensuring safe working conditions for themselves and fellow personnel, and complying with all work control documents, procedures, and permits.

The **ISMS** is focused on the **system** side of conducting operations and **VPP** concentrates on the **people** aspect of conducting work. Both programs define work scope, identify and analyze hazards, and mitigate the hazards. Additional information on these programs is available on the INEEL Intranet. Bechtel BWXT Idaho, LLC (current primary management and operating contractor) and its subcontractors participate in VPP and ISMS for the safety of their employees. This document includes all elements of both systems. The five key elements of VPP and ISMS and their corresponding HASP sections are as follows:

Voluntary Protection Program	Integrated Safety Management System	Health and Safety Plan Section
	Define work scope	Section 1
Work site analysis	Analyze hazards	Section 2, 3, 5, 8
Hazard prevention and control	Develop and implement controls	Section 2, 3, 4, 5, 7, 10, and 11
Safety and health training	Perform within work controls	Section 6
Employee involvement	Perform work within controls	Section 2, 3, and 4
Management leadership	Provide feedback and improvement	Section 6, 9

4.2 General Safe-Work Practices

Sections 1 and 2 defined the project scope of work and associated project-specific hazards and mitigation. The following practices are mandatory for all project personnel to further reduce the likelihood of accidents and injuries. All visitors permitted to enter work areas must follow these requirements. Failure to follow these practices may result in disciplinary actions or permanent removal from the project. The project FTL and HSO will be responsible for ensuring that the following safe-work practices are adhered to at the project site:

- Limit work area access to authorized personnel only in accordance with Section 7.
- All personnel have the authority to initiate STOP WORK actions in accordance with PRD-1004 or MCP-553.
- Personnel will not eat, drink, chew gum or tobacco, smoke, apply sunscreen, or perform any other practice that increases the probability of hand-to-mouth transfer and ingestion of materials in work areas, except within designated areas.
- Be aware of and comply with all safety signs, tags, and barriers.
- Be alert for dangerous situations, strong or irritating odors, airborne dusts or vapors, and spills that may be present. Report all potentially dangerous situations to the FTL or HSO.
- Avoid direct contact with hazardous materials and waste. Personnel will not walk through spills or other areas of contamination and will avoid kneeling, leaning, or sitting on equipment or surfaces that may be contaminated.
- Be familiar with the physical characteristics of the project site, including, but not limited to:
    - Prevailing wind direction
    - Location of fellow personnel, equipment, and vehicles
    - Communications at the project site
    - Type of hazardous materials stored and waste disposed of on the project site
    - Major roads and means of access to and from the project site
    - Location of emergency equipment
    - Warning devices and alarms for area or facility
    - Capabilities and location of nearest emergency assistance.
- Report all broken skin or open wounds to the operations manager, FTL, or HSO. An OMP physician must examine all wounds to determine the nature and extent of the injury. If required to enter into a radiological contamination area, a RadCon supervisor will determine whether the wound can be bandaged adequately in accordance with Article 542 of the *INEEL Radiological Control Manual* (Manual 15A).

- Prevent releases of hazardous materials. If a spill occurs, personnel must try to isolate the source (if possible, and if this does not create a greater exposure potential) and then report it to the FTL or HSO. The Warning Communications Center (WCC) will be notified, and additional actions will be taken as described in Section 10. Appropriate spill response kits or other containment and absorbent materials will be maintained at the project site.

- Illumination levels during project tasks will be in accordance with 29 CFR 1910.120 (Table H-120.1, "Minimum Illumination Intensities in Foot-Candles").

- Ground-fault protection will be provided whenever electrical equipment is used outdoors.

- Keep all ignition sources at least 15 m (50 ft) from explosive or flammable environments and use nonsparking, explosion-proof equipment, if advised to do so by safety professionals.

- Follow all safety and radiological precautions and limitations of technical procedures and requirements identified in work packages.

4.3 Subcontractor Responsibilities

Subcontractors are responsible for meeting all applicable INEEL MCP, PRD, VPP, and ISMS flow-down requirements and contract general and special conditions. Subcontractors are also expected to take a proactive role in hazard identification and mitigation while conducting project tasks and report unmitigated hazards to the appropriate project point of contact after taking mitigative actions within the documented work controls.

4.4 Radiological and Chemical Exposure Prevention

Exposure to potential chemical, radiological, and physical hazards will be mitigated by the use of engineering controls, administrative controls, or PPE to prevent exposures where possible or minimize them where engineering controls are not feasible. All project personnel are responsible for understanding the hazard identification and mitigation measures necessary to prevent exposures.

4.4.1 Radiological Exposure Prevention—As Low as Reasonably Achievable Principles

Radiation exposure of project personnel will be controlled such that radiation exposures are well below regulatory limits and that there is no radiation exposure without commensurate benefit. **Unplanned and preventable exposures are considered unacceptable.** All project tasks will be evaluated with the goal of eliminating or minimizing exposures. All project personnel have the responsibility for following as-low-as reasonably achievable (ALARA) principles and practices and personnel working at the site must strive to keep both external and internal radiation doses ALARA.

Radiological work permits will be written, as required, for project tasks that will define hold points, required dosimetry, RCT coverage, radiological controlled areas, and radiological limiting conditions in accordance with MCP-7, "Radiological Work Permit." Radiological Control personnel will participate in the prejob briefing required by MCP-3003, "Performing Pre-Job Briefings and Post-Job Reviews," to ensure that all personnel understand the dose rate limits and limiting conditions on the RWP. All personnel will be required to read and acknowledge the RWP requirements before being allowed to sign the RWP (or scan the RWP bar code) and obtain electronic dosimetry.

Monitoring for radiation and contamination during project tasks will be conducted in accordance with the RWP; PRD-183, *Manual 15A—Radiation Protection—INEEL Radiological Controls; Manual 15B—Radiation Protection Procedures; Manual 15C—Radiological Control Procedures;* and as deemed appropriate by RadCon personnel.

4.4.2 Chemical and Physical Hazard Exposure Avoidance

Threshold-limit values (TLVs) or other occupational exposure limits have been established for numerous chemicals and physical agents (e.g., noise, heat, or cold stress) that may be encountered. These exposure limits provide guidelines in evaluating airborne, skin, and physical agent exposures. The TLVs represent levels and conditions under which it is believed that nearly all workers may be exposed day after day without adverse health effects. The TLV-TWA is a time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects. Action limits (instantaneous concentrations for short time periods) have been established (Section 3) to further reduce the likelihood of exceeding TLVs.

Controls will be employed to eliminate or mitigate chemical and physical hazards wherever feasible. The hierarchy of controls in order is (1) engineering controls, (2) administrative controls, and (3) PPE. In addition to these controls, use of technical procedures and work orders, hold points, training, and monitoring of hazards will be used, as appropriate, to reduce exposure potential. Some methods of exposure avoidance include:

- Wearing all required PPE, inspecting all pieces before donning, and taping all seams
- Changing PPE if it becomes damaged or shows signs of degrading
- Minimizing time in direct contact with hazardous material or waste
- Doff PPE following standard practices (i.e., rolling outer surfaces in and down) and follow doffing sequence
- Wash hands and face before eating, drinking, smoking, or engaging in other activities that may provide a pathway for contaminants.

4.5 Buddy System

The two-person, or buddy system, will be used during project tasks. The buddy system is most often used during project activities requiring the use of protective clothing and respiratory protection where heat stress and other hazards may impede a person's ability to self-rescue. The buddy system requires each employee to assess and monitor his or her buddy's mental and physical well-being during the course of the operation. A buddy must be able to perform the following activities:

- Provide assistance if required
- Verify the integrity of PPE
- Observe his or her buddy for signs and symptoms of heat stress, cold stress, or contaminant exposure
- Notify other personnel in the area if emergency assistance is needed.

The buddy system will be administered by the subcontract technical representative, FTL, or HSO.